

1. In a survey, 100 students were asked “do you prefer to watch television or play sport?” Of the 46 boys in the survey, 33 said they would choose sport, while 29 girls made this choice.



By completing this table or otherwise, find the probability that

- (a) a student selected at random prefers to watch television;  
(b) a student prefers to watch television, given that the student is a boy.

*Working:*

*Answers:*

(a)

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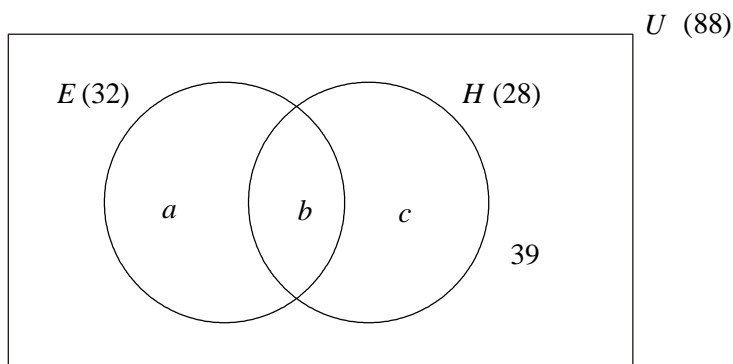
(b)

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**(Total 4 marks)**

2. In a school of 88 boys, 32 study economics (E), 28 study history (H) and 39 do not study either subject. This information is represented in the following Venn diagram.



- (a) Calculate the values  $a$ ,  $b$ ,  $c$ . (4)
- (b) A student is selected at random.
- (i) Calculate the probability that he studies **both** economics and history.
- (ii) Given that he studies economics, calculate the probability that he does **not** study history. (3)
- (c) A group of three students is selected at random from the school.
- (i) Calculate the probability that none of these students studies economics.
- (ii) Calculate the probability that at least one of these students studies economics. (5)

(Total 12 marks)

3. Two restaurants, *Center* and *New*, sell fish rolls and salads.

Let  $F$  be the event a customer chooses a fish roll.

Let  $S$  be the event a customer chooses a salad.

Let  $N$  be the event a customer chooses neither a fish roll nor a salad.

In the *Center* restaurant  $P(F) = 0.31$ ,  $P(S) = 0.62$ ,  $P(N) = 0.14$ .

- (a) Show that  $P(F \cap S) = 0.07$ .

(3)

- (b) Given that a customer chooses a salad, find the probability the customer also chooses a fish roll. (3)

- (c) Are  $F$  and  $S$  independent events? Justify your answer. (3)

At *New* restaurant,  $P(N) = 0.14$ . Twice as many customers choose a salad as choose a fish roll. Choosing a fish roll is **independent** of choosing a salad.

- (d) Find the probability that a fish roll is chosen. (7)
- (Total 16 marks)

4. Consider the events  $A$  and  $B$ , where  $P(A) = \frac{2}{5}$ ,  $P(B') = \frac{1}{4}$  and  $P(A \cup B) = \frac{7}{8}$ .

(a) Write down  $P(B)$ .

(b) Find  $P(A \cap B)$ .

(c) Find  $P(A | B)$ .

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(Total 6 marks)

5. In a class, 40 students take chemistry only, 30 take physics only, 20 take both chemistry and physics, and 60 take neither.
- (a) Find the probability that a student takes physics given that the student takes chemistry.
  - (b) Find the probability that a student takes physics given that the student does **not** take chemistry.
  - (c) State whether the events “taking chemistry” and “taking physics” are mutually exclusive, independent, or neither. Justify your answer.

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(Total 6 marks)

6. In a survey of 200 people, 90 of whom were female, it was found that 60 people were unemployed, including 20 males.

(a) Using this information, complete the table below.

	Males	Females	Totals
Unemployed			
Employed			
Totals			200

(b) If a person is selected at random from this group of 200, find the probability that this person is

- (i) an unemployed female;
- (ii) a male, given that the person is employed.

*Working:*

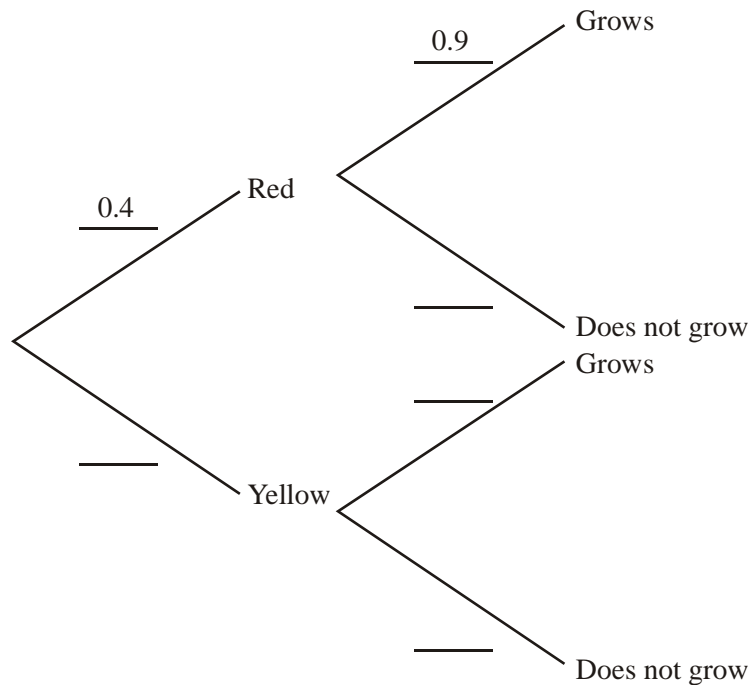
*Answers:*

- (b) (i) .....
- (ii) .....

**(Total 4 marks)**

7. A packet of seeds contains 40% red seeds and 60% yellow seeds. The probability that a red seed grows is 0.9, and that a yellow seed grows is 0.8. A seed is chosen at random from the packet.

(a) Complete the probability tree diagram below.



(3)

- (b) (i) Calculate the probability that the chosen seed is red and grows.  
(ii) Calculate the probability that the chosen seed grows.  
(iii) Given that the seed grows, calculate the probability that it is red.

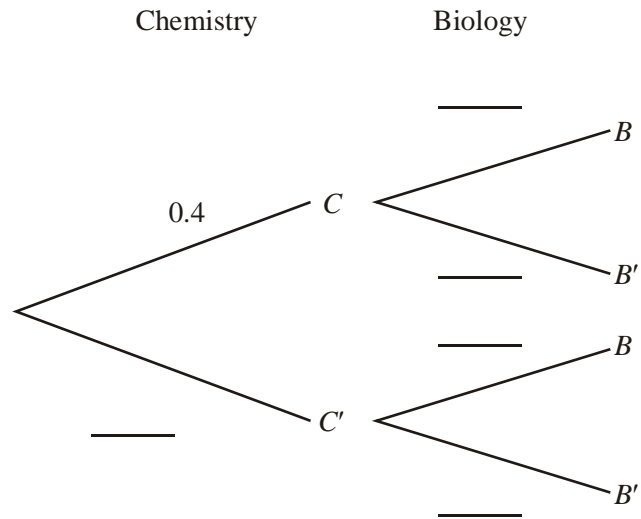
(7)

(Total 10 marks)

8. The events  $B$  and  $C$  are dependent, where  $C$  is the event “a student takes Chemistry”, and  $B$  is the event “a student takes Biology”. It is known that

$$P(C) = 0.4, P(B | C) = 0.6, P(B | C') = 0.5.$$

- (a) Complete the following tree diagram.



- Calculate the probability that a student takes Biology.
- Given that a student takes Biology, what is the probability that the student takes Chemistry?

*Working:*

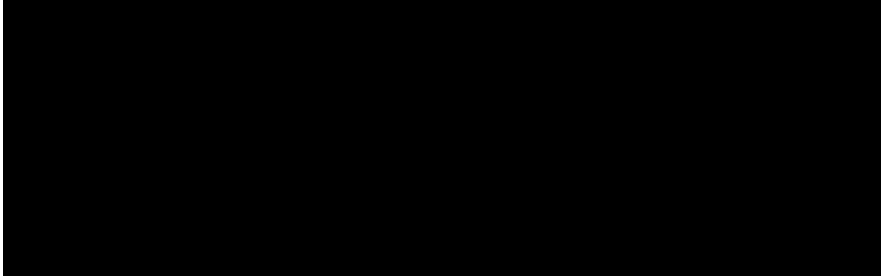
*Answers:*

- (b)
- .....
- ...
- (c)
- .....
- ...

**(Total 4 marks)**



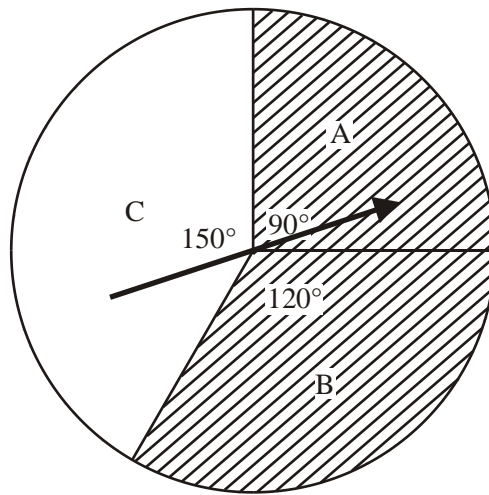
9. The table below shows the subjects studied by 210 students at a college.



- (a) A student from the college is selected at random.  
Let  $A$  be the event the student studies Art.  
Let  $B$  be the event the student is in Year 2.
- (i) Find  $P(A)$ .
- (ii) Find the probability that the student is a Year 2 Art student.
- (iii) Are the events  $A$  and  $B$  independent? Justify your answer. (6)
- (b) Given that a History student is selected at random, calculate the probability that the student is in Year 1. (2)
- (c) Two students are selected at random from the college. Calculate the probability that one student is in Year 1, and the other in Year 2.

(4)  
(Total 12 marks)

10. The following diagram shows a circle divided into three sectors A, B and C. The angles at the centre of the circle are  $90^\circ$ ,  $120^\circ$  and  $150^\circ$ . Sectors A and B are shaded as shown.



The arrow is spun. It cannot land on the lines between the sectors. Let  $A$ ,  $B$ ,  $C$  and  $S$  be the events defined by

- $A$ : Arrow lands in sector A
- $B$ : Arrow lands in sector B
- $C$ : Arrow lands in sector C
- $S$ : Arrow lands in a shaded region.

Find

(a)  $P(B)$ ;

(b)  $P(S)$ ;

(c)  $P(A|S)$ .

*Working:*

*Answers:*

(a) .....

(b) .....

(c) .....

**(Total 6 marks)**

11. Let  $A$  and  $B$  be events such that  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{3}{4}$  and  $P(A \cup B) = \frac{7}{8}$ .

- (a) Calculate  $P(A \cap B)$ .
- (b) Calculate  $P(A|B)$ .
- (c) Are the events  $A$  and  $B$  independent? Give a reason for your answer.

*Working:*

*Answers:*

- (a) .....
- (b) .....
- (c) .....

**(Total 6 marks)**

12. Consider events  $A, B$  such that  $P(A) \neq 0$ ,  $P(A) \neq 1$ ,  $P(B) \neq 0$ , and  $P(B) \neq 1$ .

In each of the situations (a), (b), (c) below state whether  $A$  and  $B$  are

mutually exclusive (M);  
independent (I);  
neither (N).

- (a)  $P(A|B) = P(A)$   
(b)  $P(A \cap B) = 0$   
(c)  $P(A \cap B) = P(A)$

*Working:*

*Answers:*

- (a) .....  
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(b) .....  
...  
(c) .....  
...

**(Total 6 marks)**